NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

COMMERCIAL FISHPONDS

(Acre)

CODE 397

DEFINITION

A water impoundment constructed and managed for commercial aquaculture production.

PURPOSES

To provide a favorable water environment for producing, growing, harvesting, and marketing commercial aquaculture crops.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to:

- Impoundments that store water and are managed for commercial aquaculture purposes.
- All types of ponds installed or modified for commercial production of fish.
- Class (a) dams having a product of storage times effective height of dam less than 3,000 acre-ft^2 and effective height of dam less than 35 feet.

CRITERIA

General

The site must be protected from sedimentation and contamination. The soils within the pond area, as well as those in the contributing drainage area, must be checked for residues of pesticides and other harmful chemicals if there is a possibility of contamination. Acid soils should be limed to achieve a neutral condition for best production.

Commercial fishponds may be: (1) embankment ponds that intercept and store surface runoff water, or (2) excavated ponds that are completely enclosed by an embankment around the outer perimeter and are filled by pumping.

DESIGN

Embankment ponds. Earthfill dams and embankments around excavated ponds shall meet or exceed the requirements specified for Conservation Practice Standard 378, Pond. If levees are constructed with a dragline, add 25 percent of design height for settlement. Other following additional requirements include:

1. The minimum elevation of the top of the settled embankment shall be increased to allow for wave action. This increased allowance shall be as specified in Table 1.

   Table 1. Wave height

Max. Fetch Length 1/ ft.	Wave Height ft.
<330	0.5
330-660	1.0
600-1,320	1.5
1,320-5,280	2.0

   1/ Fetch is defined as the longest uninterrupted distance traveled by wind or wave.

2. The embankment may be used as a nonpublic road for harvesting, feeding, or other management purposes. The minimum top width of the embankment will be designed to accommodate the equipment using the road.

3. Interior embankments constructed for diversion of water or to direct water flow for circulation shall have adequate cross section to provide for stability and function for its intended purpose.

Excavated ponds. Ponds established by excavating and constructing an embankment around their outer perimeter that excludes outside runoff, shall have either an emergency spillway with a bottom width of at least 10 feet or have an overflow pipe installed with sufficient capacity to remove a 10-year/24-hour direct rainfall amount in 48 hours. A minimum 8-inch diameter pipe shall be used.

A 1.0-foot-minimum freeboard from pipe outflow crest to top of fill shall be required. Levee construction shall add the required settlement to the 1.0 freeboard requirement. The pond bottom should be sloped to the outlet at a gradient of at least 0.2 foot per 100 feet. A minimum 10-foot berm shall be provided between the outside toe of levee and top of bank of outlet drainage ditch.

Orientation. Rectangular ponds shall be positioned with the long axis perpendicular to the prevailing wind.

Water supply. Wells are the most desirable source of water, but any available source may be used if the quality and quantity are adequate. If water is pumped from rivers and streams or other sources where undesirable fish, pesticide residue, fish disease, and parasites may be introduced, filters must be installed on the intake.

With only surface runoff supplying the pond with water, the minimum ratio of drainage area to the surface area should be 5:1 with a ratio of 8:1 preferred.

The minimum incoming water supply for adequate maintenance is considered to be 15 to 25 gal/min/acre (0.4 to 0.6 L/s/ha). However, evaporation rates, fish-stocking densities, and species requirements will be used in establishing specific rates. Flow rates shall be measured during periods of lowest flow. The pumping and pipeline facilities shall be located to best serve the pond, taking into account accessibility for maintenance and repair; protection from overflow and flood hazards; connections to power lines; access to fuel sources; and future expansion. Water entering the pond should be aerated to increase dissolved oxygen and dissipate harmful gases if needed. This can be accomplished by falling, splashing, spraying, etc. Also, incoming water shall be as far away from outlet drains as possible so that rapid removal of fresh water will be avoided. The desired free oxygen level in ponds is 3 to 5 parts per million, and fish kills may result at less than 2 parts per million. The oxygen level is typically lower in hot weather than in cold weather. Catfish grow rapidly when water temperature is 70 to 80 degrees F. The desirable water pH range is 6.5 to 9.0.

Pipes and conduits. Pump discharge through levees shall be installed above expected high water, and provisions shall be made to prevent pump and motor vibrations from being transmitted to discharge conduits. Table 3 provides an estimate of the time required to fill selected size ponds with different well flow rates.

Size. Variable pond size may be used depending on water supply, harvesting methods, topography, and markets. New producers should consider ponds in the 10- to 12-acre range for ease of management and harvest.

Depth. The preferred water depths for various species are as shown in Table 2.

Table 2. Water depth for various species

	Most Desirable		Minimum	
Species	(feet)	(meter)	(feet)	(meter)
Channel catfish	4-6	1.2-1.8	2.5	0.76 1/
Sportfish (bass, bluegill)	4-6	1.2-1.8	3.0	0.90
Minnow, other baitfish	4-6	1.2-1.8	3.0	0.90

1/ Ponds used for cage culture shall have a minimum depth of 5 feet (1.5 m) where cages are located. (Minimum clearance below cage and pond bottom is 1 foot, but as much as 3 feet is preferred.)

Drains. The pond must have facilities for complete as well as partial drainage. Turn-down pipes, quick-release valves, bottom-water release sleeves, or other devices for water level control and pond management are to be included in the construction of the drain facility as appropriate. Conservation Practice Standard 378, Pond, shall be followed for

conduit design and installation of anti-seep collars.

Pond bottom. Where fish are harvested by seining, the pond bottom shall be smoothed and free of all stumps, trees, roots, and other debris. Existing channels and depressions in the pond area shall be filled and smoothed. The edges of the pond should be deepened to provide at least 3 feet of water and the deepest area will be no more than 6 feet deep where possible to facilitate harvesting.

Access and safety. Provisions shall be made for access to the site as well as access for operation and maintenance. Gravel on the levees will permit vehicle travel for feeding or harvesting during wet weather. Ramps shall be located as necessary to accommodate aeration and harvesting equipment. The maximum grade for equipment access shall be 20 percent (5:1 slope). Generally, level areas or restraining barriers shall be provided to protect pumps, motors, fuel tanks, and utility poles from vehicular traffic. Appropriate safety features and devices shall be installed or made available close by to aid people who fall into the pond and to prevent such accidents.

Protection. A protective cover of vegetation shall be established on all exposed soil surfaces that have been disturbed. If soil or climatic conditions preclude the use of vegetation, other protection methods may be used. Adequate provisions must be made to protect earth surfaces from wave erosion and turbulent water at pipe inlets and outlets. Fences shall be installed as necessary to exclude livestock and unwanted traffic. Road surfaces shall be treated if necessary to prevent vehicles from cutting deep ruts or sliding into the pond. Dams and levees shall be crowned to provide positive drainage.

CONSIDERATIONS

General

The owner/operator's objectives will dictate the level of development and management to be planned. The plan must be based on the limitations and potentials of available natural resources. Soil conditions, climate, water resources, and topography must be suitable for constructing a pond or reservoir for commercial aquaculture production. A thorough aquaculture resource assessment must be made to determine the feasibility of the project. The planning is complete when all practice components essential to reaching the cooperator's management objectives have been identified.

Other planning considerations include the following:

- Application of practical pond management techniques should achieve the desired level of production on a predictable basis.
- Access to the site is available or can be constructed and maintained.
- Ponds should store the recommended depth and area of water needed for specific aquaculture products.
- The location, design, and installation of ponds will comply with flood plain, wetland, and prime farmland regulations.

Water quantity.

Water quantity will be adequate considering evaporation, seepage, and the need for water exchange. Consider the following:

- The effects on the water budget with emphasis on effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
- The effects on the volume of downstream flow or aquifers that might cause undesirable environmental, social, or economic effects and contribute to water table decline from heavy pumping.

Water quality.

Water quality will be suitable for use in aquaculture production or can be made satisfactory by adequate treatment. Consider the following:

- Provisions will be made for any needed treatment of water released downstream from the pond.
- Effects on erosion and the movement of sediment, organics, and soluble and sediment-attached substances.
- Effects on the visual quality of water resources.

- Short-term and construction-related effects on the water resources.
- Effects on the temperature of water discharged.
- Effects on the movement of dissolved substances below the root zone and toward ground water.
- Potential for redistributing toxic materials during earth moving.

PLANS AND SPECIFICATIONS

Plans for constructing commercial fishponds shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

Specifications for construction and installation of commercial fishponds shall use, or be in conformance with, requirements of the attached "construction specification." Any variation from these specifications shall be approved by an engineer.

OPERATION AND MAINTENANCE

Each pond should be arranged so that it can be managed independently of others to facilitate harvesting and the control of parasites and disease. Ponds from 2 to 20 acres are desirable for commercial production and ½ to 10 acres for hatchery and fingerling ponds. A plan for operation and maintenance should be prepared for use by those responsible for the system. This plan should provide for inspection, operation, and maintenance of vegetation, pipes, valves, spillways, roads, and other parts of the system. Renovation of older ponds for commercial production shall meet the above requirements.

Table 3. Filling time in hours for various size ponds to a depth of 4 feet using various capacity wells.

Assumptions:	326,000 gal. = 1 acre foot (ac-ft) 1 cubic foot per second (cfs) = 450 gallons per minute (gpm) = 2 ac-ft per 24 hours Pond has flat bottom.

CFS		0.44	0.89	1.33	1.78	2.22	2.67	3.11	3.56	4.00	4.44	4.89	5.33
GPM		200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400
Acres	Acre Feet	Hours to Fill Ponds with 4 Ft Depth of Water											
0.5	2	54.4	27.2	18.1	13.6	10.8	9.1	7.8	6.8	6.1	5.4	4.9	4.5
1.0	4	108.7	54.3	36.2	27.2	21.6	18.1	15.5	13.6	12.1	10.9	9.9	9.1
2.0	8	217	109	72	54	43	36	31	27	24	22	20	18
5.0	20	544	272	181	136	108	91	78	68	61	55	50	46
10	40	1087	543	362	272	216	181	155	136	121	109	99	91
15	60	1631	815	543	408	324	272	233	204	182	164	149	137
20	80	2174	1086	724	544	432	362	310	272	242	218	198	182
25	100		1358	905	680	540	453	388	340	303	273	248	228
30	120		1629	1086	816	648	543	465	408	363	327	297	273
35	140		1900	1267	952	756	634	543	476	424	382	347	319
40	160		2172	1448	1088	864	724	620	544	484	436	396	364
45	180			1629	1224	972	815	698	612	545	491	446	410
50	200			1810	1360	1080	905	775	680	605	545	495	455
60	240			2172	1632	1296	1086	930	816	726	654	594	546
70	280				1904	1512	1267	1085	952	847	763	693	637
80	320				2176	1728	1448	1240	1088	968	872	792	728
90	360					1944	1629	1395	1224	1089	981	891	819
100	400					2160	1810	1550	1360	1210	1090	990	910

$$\text{Time (hours)} = \frac{5{,}445 \times \text{Volume (ac-ft)}}{\text{Flow (gpm)}} = \frac{12.1 \times \text{Volume (ac-ft)}}{\text{Flow (cfs)}}$$

NRCS, KS
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